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The Economic Legacy of Civil War: Firm Level Evidence from Sierra Leone

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Abstract

This paper positions itself among the very rare microeconomic analyses on the consequences of civil war. Up to now, most analyses on this topic are based upon household surveys. The originality of the present study is that it investigates for the first time the likely predominant route by which civil conflict affects the economy, namely through firms. The context of the study is Sierra Leone, a country that was ravaged by a violent conflict from 1991 to 2002. The approach is to use geographical variations in the intensity of conflict to estimate the impact of violence on firms, on which we have data from the World Bank 2007 Employers Survey. The proposed theory is that during the conflict, violence affects production through a form of technical regress and demand through a reduction in income. The persistent post-conflict effects are yet less obvious…/

Keywords: entrepreneurship, national systems of innovation, SMEs, innovative capabilities, emerging economies

JEL classification: O01, O33, L26

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We assume that war forces a prolonged contraction in output skills, which slows the pace of recovery. We termed this phenomenon 'forgetting by not doing'. The results confirm our theory. Civil war negatively impacts the existence of firms and employment, but there is no distinction between regions. However, the size of firms in 2006 is negatively affected by the intensity of the war in the area it operates. Yet, firms tend to grow twice faster in more affected areas, strikingly matching the macroeconomic rate of recovery post-conflict environments (Collier and Hoeffler, 2004). The analysis of training patterns clearly confirms the long lasting lack of skills experienced as a result of the war in areas where the conflict was more intense.

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1 Introduction

Civil war is a difficult context for applied economic research. To date, the economic consequences of civil war and its aftermath have been investigated predominantly at the macroeconomic level, using national accounts data to estimate the impact on GDP (Barro, 1991; Collier, 1999; Collier and Hoeffler, 2004). The relatively rare microeconomic analyses have been based upon household survey data, focusing upon the vulnerability to violence (Deininger, 2003) and the effect of being a victim of violence upon subsequent political participation (Bellows and Miguel, 2007). Yet, the predominant route by which civil war affects the economy is likely to be through firms. To our knowledge, the present study is the first to use firm level data to investigate the effects of civil war and post-conflict recovery. The added value of such an analysis lies in the microeconomic evidence. We fully acknowledge that the poor quality of the dataset calls for further investigation to allow robust conclusions.

The context of the research is Sierra Leone. Between 1991 and 2002 Sierra Leone was ravaged by an extremely violent civil war. The war led to over 50,000 deaths, the displacement of 500,000 civilians, and a wholesale destruction of the national economy. By the end of the war, Sierra Leone had sunk to the bottom of the United Nations Development Programme's (UNDP) Human Development Index (HDI). In 2002, peace was achieved by the intervention of British troops: the insurgent Revolutionary United Front rapidly collapsed. Since then security has been maintained without significant challenge, aided by a continued British military presence. Yet, the pace of recovery has been modest: in 2008, the most recent year for which data is available, the country remained at the bottom of the HDI.
While the conflict in Sierra Leone was intense and prolonged, it was concentrated in particular locations. Household data analysed by Bellows and Miguel (2007) provides a reasonable measure of this spatial variation. Our approach is to use this variation to estimate the impact of violence on the growth of firms, on which we have data from a firm survey. Clearly, even firms in areas not directly affected by violence were nevertheless operating in a country at civil war and this is likely to have affected their performance. During war time government policies will deteriorate, trade with conflict-affected areas will be reduced, and firms may fear that violence will spread to their own area. Hence, our approach is likely to underestimate the full effects of civil war and so should be thought of as a lower bound.

How might exposure to the violence of civil war affect firms? In Section 2 we propose a simple theory. The effects during war are straightforward: violence affects production through a form of technical regress and demand through a reduction in income. However, the persistent post-conflict effects are less obvious: we propose a phenomenon that we term 'forgetting by not doing'. In essence, war forces a prolonged contraction in output, skills atrophy through neglect and this slows the pace of recovery. In Section 3 we describe the context of the war in Sierra Leone, and in Section 4 our data. Section 5 presents our results.

2 The Effect of civil war on firm performance

The most striking visual images of violence are those of physical destruction. These effects are potentially persistent even after the conflict has ended. However, in low income countries they may be relatively minor: there is little capital at risk and after the conflict replacements can swiftly be imported. Miguel and Roland (2006) study the effects of the bombing of Vietnam, probably the most destructive civil war in any developing country and clearly far more destructive than that in Sierra Leone. They find that the bombing left no discernable long term economic effects. Cerra and Saxena (2008) observe that output partially rebounds after a civil war, in contrast to financial crises. Using a panel data they found that half the loss is recuperated after four years, while the other half of cumulative loss remains after a decade. They explain this characteristic rebound by the fact that rebuilt infrastructures can be repaired within a short time. However, they do not formulate any hypothesis about the causes of the persistent loss. Rather than physical destruction, the most important effects of civil war violence on firms are likely to have been the disruption of production through the flight of employees, the unreliability of transport, and the fear of looting. Faced with unreliable transport, firms would normally have carried larger inventories, but the fear of looting would warrant the opposite response. Such costs of disruption can be characterized as technical regress in the formal, private sector of the economy and so raise the unit cost of its output.

Firms are also affected by a decline in demand. This is driven by the decline in incomes, and more particularly cash incomes, as people move liquid assets abroad for safety and shift into subsistence activities. The demand for the output of the formal private sector is thus reduced through a combination of the higher unit cost of its output and the reduced cash income of the wider economy.

These effects in themselves appear to be readily reversible, so that post-conflict recovery should be rapid. With a secure peace productivity, the demand would be restored. Why might the cost of conflict be more persistent? We propose that in low income countries such as Sierra Leone the key channel for persistence is not physical, but human capital, and that the key route by which human capital is lost is through the atrophy of skills.

Skills are maintained through use. The theory of 'learning by doing' (Arrow, 1962) proposed that 'doing' was the main mechanism for learning, but more evidently it is essential to the retention of task-specific knowledge. The technical regress induced by civil war reduces the maintenance of skills through two effects. Directly, technical regress amounts to the reversion to production practices, which

in normal times would be inefficient. For example, if there is no electricity, workers may need to switch to manual operations. In effect, they learn reversionary techniques which peace will make redundant, and forget techniques which peace will again make feasible and superior. Indirectly, technical regress reduces the maintenance of skills through its aggregate effect on income and hence on demand. Indirectly, the contraction of output in response to the decline in demand leads to a contraction in the labour force, though less than proportionately due to the productivity decline. The decline in employment then deskills that part of the labour force that loses employment in the activity, in a process analogous to the deskilling of workers who remain unemployed for long periods, although this literature has essentially been studied in developed economies. Pissarides (1992) uses a stylized model to emphasize that the loss of skills associated with unemployment persistence can have long lasting consequences and may explain the observed slow adjustment of the labour market after a temporary shock on employment. This easily relates to our theory that the most persistent consequence of war is the destruction of human capital. The 'effect of the business cycle' (Dynarski and Sheffrin, 1990; Baker, 1992) translates into an increase of unemployment length during economic recession. Indeed, the outflow rate for long term unemployment collapses during recession as employers have larger pools of labour to choose from. Of course, in developed countries, wages would adjust and unions would play a major role. In Europe, Machin and Manning (1999) conclude that higher rates of long term unemployment put an upwards pressure on wages that tend to be higher in periods of large unemployment. Although the phenomenon is similar to the deskilling of unemployed workers, the recovery mechanisms are likely to be different in the case of post-conflict as most workers are employed in the informal sector.

The atrophy of skills through reversionary technology and reduced employment is only of consequence once peace is restored. Having adjusted to the conditions of conflict, with the onset of peace firms find themselves in a favourable disequilibrium. Demand increases and there is now scope to abandon the reversionary technologies. In response to the disequilibrium firms expand, but in doing so they encounter a shortage of skilled labour. Firms in conflict-affected areas must therefore make do with lower quality workers and hence have lower productivity.

This simple theory of the effect of conflict and its legacy on firms has testable implications. The most evident is that during conflict those firms in areas most affected by conflict would contract relative to those in less affected areas. Similarly, in post-conflict, we would expect this pattern to be reversed. A less evident testable implication is that, in the post-conflict phase, there would be an apparent paradox: the fastest growing firms would be less productive. Finally, in the post-conflict phase, those firms in conflict-affected areas would manifest the most severe shortage of skilled labour.

Taking a Cobb-Douglas production function where Y the production level at date t depends on the

level of K, the stock of capital at time t, L the stock of labour, and A the stock of knowledge. Arrows (1962) defines the learning by doing effect as:

$$A_t = BK_t^{\phi} \tag{1}$$

with $B > 0$; $\phi > 0$ and $K_t = sY_t$ where s is the saving rate.
This, however, does not enable us to capture the impact on the stock of knowledge A of a decrease in production from the previous periods which leads to the resurrection of reversionary technologies, and so a loss of skill in cutting-edge technologies. One way to model such an effect would be to introduce the concept of previous peak output, and allow A to decline in responses to shortfalls of current output from previous peak output. Thus, to capture this effect of forgetting by not doing we rewrite (1):

$$A_t = BK_t^{\phi} + C \triangle Y_t \delta_{\triangle Y_t < 0} \tag{2}$$

where $\delta_{\triangle Y t} = 1$ if $\triangle Y_t < 0$ and 0 otherwise and $C < 0$. In other words when $\triangle Y_t > 0$, we observe the standard 'learning by doing' effect, but when $\triangle Y_t < 0$, which is characteristic of conflict environment, the 'learning by doing' effect is replaced by a 'forgetting by not doing' effect. As production shrinks during the war when activity reverts to subsistence, the level of knowledge of the economy A, decreases from its previous level.

This paper is an attempt to test the veracity of our 'forgetting by not doing' theory using country level data on Sierra Leone. Without a doubt, the main contribution to the existing literature therefore stands at the micro level. The idea is to investigate whether firms in zones highly affected by the war behave differently five years after the end of the conflict. In particular, do those firms face higher shortages in human capital and as a result a higher demand for skills? This would confirm that firms in conflict-affected areas have to make do with lower quality workers and consequently, that the persistent effect of war on firms is through human capital. In order for us to fully validate our theory, we need to make sure that our analysis does not capture a completely different story. Indeed, a higher demand for human capital could serve as a substitute for physical investment. Machines, for example, might be too expensive to import and, as a consequence, employers would invest into human capital to compensate the lack of machines. Even workers who previously worked on machines might need to be trained to work manually. If this constitutes reality there is a danger in interpreting investment in human capital as validating the 'forgetting by not doing' while in fact the effects of war are on physical capital.

To avoid misinterpretation we need to discuss the physical capital-labour complementarity versus substitutability. However, as is always the case in analyses focusing on post-conflict environments, we face problems with the quality of the data. One of the main limitations is that we have very little

information on firms prior to the shock. In particular we have no information on the capital/labour intensity by sectors prior to the war. We also cannot estimate a production function with precision as we do not have data on wages or costs of capital. One solution would be to compare Sierra Leone with countries with similar characteristics, by sector, for example Ghana. This looks like an attractive option, however, we could not find any research investigating the capital-labour complementarity in comparable countries. The research on Ghana mainly focuses on the manufacturing sector. Teal (2000), while investigating the fall in real wages in the 1990s, finds that the elasticity of substitution between unskilled labour and capital is higher than between skilled labour and capital. Duffy et al. (2004) use a cross section panel of 73 developed and developing countries over 25 years to investigate the labour-skill complementarity. Using a lower than usual threshold for skilled capital - some primary school, completed primary school, some secondary - they find some evidence of capital-skills complementarity. This confirms the mild evidence found by Fallon and Layard (1975) using a cross-country data for the year 1963. Most of the existing country level literature on the subject is based on developed countries data, from which we cannot draw any sensible conclusion for a lowest income country.

As a result, we cannot realistically conclude whether physical and human capital are substitutes or complements in Sierra Leone, although it seems that labour-skill complementarity might be more likely. Empirically, if physical investment translates into a lower need for staff training, it is likely that physical and human capital are substitutes, if it translates into a higher need to train staff, then complementarity can be assumed. If physical and human capital are complementary, then our analysis would constitute a lower bound. Indeed, in areas where the conflict was more intense, violence would have destroyed more physical capital which as a result would decrease the need for training.

3 The shadow of the civil war

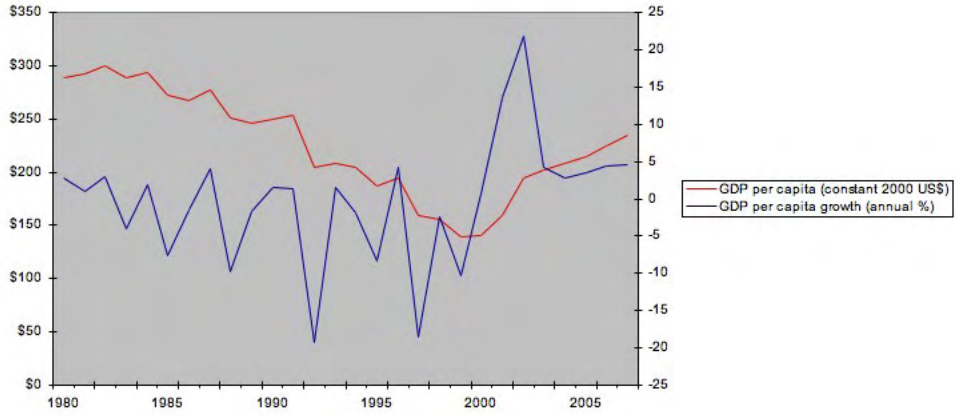
Like most of sub-Saharan Africa, Sierra Leone is noticeable for its very young population. Most of its youth, especially those from rural areas grew up during the decade long *Dirty War* (Gberie, 2005). As a result, both their human capital and transition to adulthood have been dramatically affected adding the difficulties of being an ex-combatant or a victim, the burden of forced migration and psychological long lasting traumas to widespread poverty. Many children at the time of the conflict were prevented from going to school.[1] Consequently, the literacy rate in Sierra Leone is particularly low.[2] Thirty-five per cent of the 15-24 year old and 63 per cent of the 25 to 35 year old never attended school (World Bank, 2007). Both age groups constitute the core of today's work force as life expectancy hardly reaches 41 years. Promoting employment opportunities for youth has thus been identified as a core challenge in the Sierra Leone Poverty Reduction Paper and is widely recognized as a necessity for the

[1] The conflict in Sierra Leone was characterized by the use of child soldiers in the different fighting armed factions.
[2] 39.3 per cent as opposed to 59 per cent in sub-Saharan Africa for 15 years old and above (World Bank, 2007).

political stability as a result of the predominant role played by youth during the civil war.[3]

GDP per capita dramatically fell during the 1980s, eventually leading to the war and ten years of gradual destruction of the whole economy (Figure 1). Between 1980 and 2000, the GDP per capita was halved, from a mere $300 to $150. Since 2000, the economy has been kicking off again. Yet, despite a successful period of recovery from the conflict characterized by a growth rate of GDP per capita close to 4 per cent, the government of Sierra Leone is still facing colossal challenges to promote sustainable development. In 2008, the small West African state still lay at the bottom line of the UNDP's HDI. In 2006, 70 per cent of the population still lived under the national poverty line. Recovery from two decades of war and negative growth is yet to be achieved and Sierra Leone suffers from an overall lack of economic opportunities.[4]

Figure 1: Long term trends of GDP and growth in Sierra Leone, 1980-2007



Source: WDI 2008.

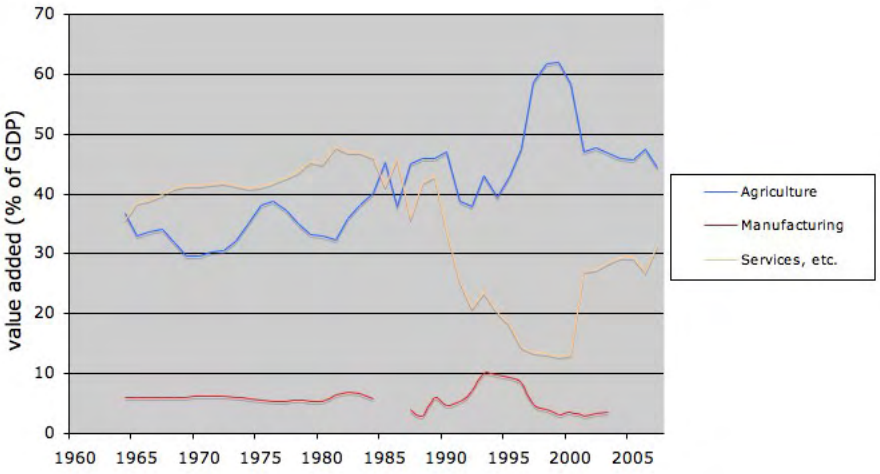
Figure 2 shows a striking return to an agricultural economy and a switch towards subsistence activities in the early 1980s when the Sierra Leonean economy started to collapse and the country fell into war. At the end of the conflict, the size of the service sector was reduced to a quarter of what it was in 1980. The relative sizes of sectors are gradually returning to their counterfactual: by 2007, the value added of the agricultural sector as a percentage of GDP follows a decreasing path up to just over 40 per cent and the service sector size reaches 30 per cent, double of what it was in 2000 but still half of its relative size in 1980. The first five years of post-conflict are characterized by a slow return to a state of the economy similar to the one prior to the 1980s.

On the business environment side the situation is similar. Investment is still shy as underlined by the

[3]The government's official definition of youth is individuals between the ages of 15 to 35 as opposed to the standard definition of 15 to 24. This has been decided to take into account the lost 10 years of conflict at the individual level.

[4]The figures are available at www.worldbank.org/sle.

Figure 2: Long term trends of the relative shares of sectors, 1964-2007

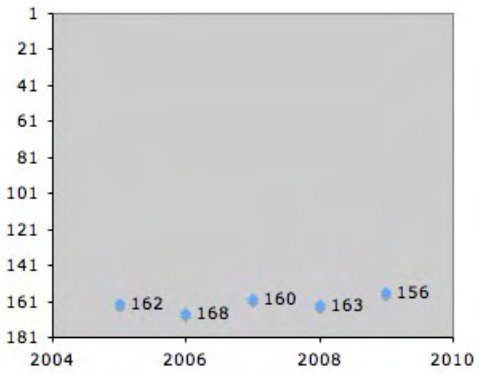


Source: WDI 2008.

rather small number of large firms operating in the country. Moreover, existing businesses face massive constraints on growth and expansion such as access to finance, due to a completely underdeveloped formal credit system, poor access to electricity,[5] and an apparent lack of resources (World Bank, 2007). The 2007 World Bank study also reports that availability of labour does not constitute a constraint in itself for firms but the availability of skilled workers remains a major problem for the largest ones. The rating of the Doing Business Initiative, which provides a national quantitative measure of different business regulations, confirms that Sierra Leone lies among the countries where it is the hardest to do business. In 2006, when the survey was undertaken, the report emphasized the difficulty of hiring and firing workers as well as of getting credit. In the 2009 Doing Business report that covers the period from April 2007 to June 2008, Sierra Leone ranks 156th out of 181 countries. Figure 3 shows the evolution of the ranking over the period covered by the initiative. If it seemed relatively easier to start a business in 2007/2008 than in the previous year (53rd rank/+41), Sierra Leonean employers face among the worst conditions in dealing with construction permits, but also in employing workers, registering property, getting credit, paying taxes, trading across borders, enforcing contracts, and in closing a business. In more details, the study reports a duration of 283 days to build a warehouse. Firing costs amount to 189 weeks of salary as opposed to an average of 68.3 weeks in the region. On the credit side, the scope, access, and quality of credit information available through public registries or private bureaus is close to nil. The costs of enforcing contracts in percentage of claims are three times higher than in the region. Overall, this difficult operating environment explains in part the slow growing path of the private sector.

[5]National electricity is, as of 2007, almost inexistent and firms and households rely on private generators running with fuel at a very high cost.

Figure 3: Sierra Leone, ease of doing business ranks



Source: Doing Business 2009.

In the context of this paper, it is necessary to highlight some of the particular features of the war. The war erupted in 1991 at the border with neighbouring Liberia and later on spread out over the entire country, reaching Freetown on Jan 6 1999. The war techniques included, among others, the systematic targeting of civilians as a terror tactic, rapes, cutting of limbs, abduction of child soldiers as well as the intensive looting of diamond resources located essentially in the areas bordering Liberia. The decade of fighting was rythmed by advancements of the rebels towards Freetown and defeats against the government army, and later on by ECOWAS peacekeepers pushing them back towards their stronghold in the East. The fighting was not dictated by the destruction of particular economic sectors, apart from mining. In other words, the variation in conflict intensity was not systematically related to the structure of the economy. On the contrary, the primary incentive was to control Freetown and as the rebel forces advanced towards their objective whatever was on the way - villages, villagers, towns - was destroyed. The war tactics were characterized by extensive looting of anything with any value such as during *Operation Pay Yourself* and by widespread killings of civilians as an effective terror tactic such as *Operation Burn House*. The deadliest illustration of the later was with no doubt *Operation No Living Thing*, the name speaks for itself.

4 Data

The Sierra Leone Employers Survey (SLES) undertaken by the World Bank in 2006[6] constitutes the core of our database. The survey covers four districts out of eleven in total: the Western urban area, which includes the capital city Freetown, the Western rural area surrounding Freetown, Bo district in the South, Bombali district in the North, and Kailahun district, the Revolutionary United Front's stronghold, in the East at the border with Liberia (see Figures 4 and 5). The data coverage well reflects the differences observed in Sierra Leone in terms of economic development as well as how the

[6]'Improving opportunities for sustainable youth employment in Sierra Leone' (World Bank, 2007).

country has been affected by the civil war in the 1990s. For our study, which focuses on firms, we only relied on the urban area data that surveyed 419 formal and 248 informal businesses.[7] All 30 large and 136 medium-sized firms were surveyed along with 502 small businesses.[8]

It is important to acknowledge a possible selection bias. Indeed, only survivor firms were surveyed and it is impossible to methodologically assess the reasons why those firms survived and others did not. This potential bias might affect the results and data is insufficient to enable correction. However, a few studies have investigated the survival of firms in Africa, and especially in Ghana, a country similar to Sierra Leone in many ways (geography, language, colonial history) with the exception that it never experienced civil war (Söderbom et al., 2005; Frazer, 2005; Söderbom and Teal, 2006). Both investigations conclude for a significant relationship between productivity and probability of exit. Nevertheless, while they also both find a size effect - that smaller firms have a higher probability of disappearing - Harding et al.'s (2006) results using data on Ghana, Kenya, and Tanzania suggest that 'creative destruction' occurs among large firms but not small firms. Is it likely that the same happened in Sierra Leone during the war? Probably. But the rate of destruction was certainly much higher, especially in war zones. So if survival rate followed the same path in Sierra Leone, small firms would have been destroyed together with less productive large firms. In fact, the productive large firms might have closed down to reopen after the war. As a result, the number of small firms is potentially lower in highly intense conflict areas. Large firms might be on average more productive than what they would have been and finally, a large proportion of small firms might have disappeared. The latter point may well have been offset at the end of the war with small business creation. The potential impact of the selection bias on each dependent variable at the firm level will be discussed in due course.

We use the number of firms per chiefdom to control for the state of the economy before the war. Such information is provided by the 'Directory of business and industry for the Western area and multiunit firms' (Sierra Leone Central Statistics Office, 1970) and the 'Directory of business and industry for the Northern, Southern and Eastern provinces' (Sierra Leone Central Statistics Office, 1968). These are, to our knowledge, the only existing documents that give some relevant economic information disaggregated at the chiefdom level before the war. A brief description of the activities of the firms allows classifying the firms by sector matching the SLES classification. Nevertheless, we need to acknowledge that the number of firms obtained as such raises some problems. First, for the Freetown area, there is no possible way to ascertain in which of the eight chiefdoms the firms where located. This forces us to treat the entire Western urban area as one single location instead of eight distinct chiefdoms.

[7] Businesses can be registered with: Administrator and Registrar Generals Office, National Social Security and Insurance Fund (NASSIT), National Revenue Authority (NRA), Ministry of Trade, Ministry of Labor, Licensing Authority, or other authority (such as Local Council and Pharmacy Board).

[8] Large businesses are defined as employing 50 workers or more, medium-sized businesses have 10 to 49 employees, and small businesses have less than 10 employees.

Second, we only obtain a picture of the economy in the early 1970s leaving a 20-year gap until the beginning of the war in 1991. However, the civil war broke out after decades of mismanagement and corruption since independence from Britain in 1967. The following decades since independence appear as premises of the coming war. Thus, 1970 gives a good snapshot of the economy before the process of collapse that culminated in the war.

The intensity of war, our variable of interest for this analysis, is calculated following Bellows and Miguel (2006). We compile the average answer by chiefdom to four questions asked to households:
- Were any members of your household killed during the war?
- Were any members of your household injured/maimed during the war?
- Did anyone from this community/neighbourhood die as the result of the conflict?
- Were any members of this community/neighbourhood injured/maimed as a result of the conflict?[9]
We are then left with four variables by chiefdoms ranging from 0 to 1.[10] We define the intensity of conflict as the mean of these four variables. It is important to mention that almost 80 per cent of the households surveyed moved to their community before 2002, we thus expect that our intensity variable represents the reality and is not based on population movements. Bellows and Miguel (2006) used information on whether any members of the responding household were made refugees during the war instead of the information focusing on the wider community level. We use their slightly different measure of conflict intensity to check the robustness of our results.

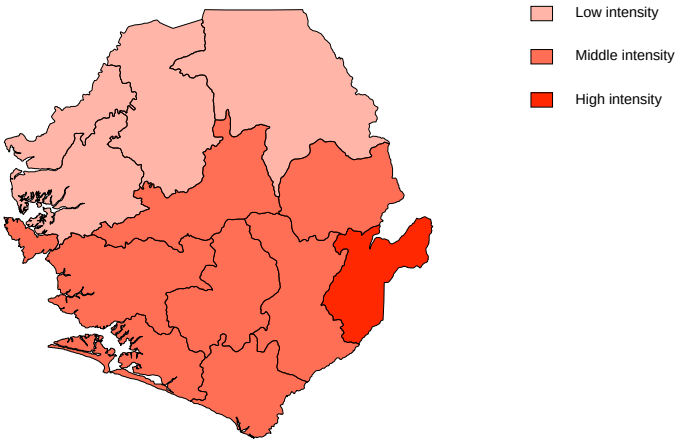
A problem of endogeneity may arise from the fact that higher intensity areas might have had intrinsic characteristics making them more likely to be affected by hostilities. This could lead to biased estimators in our regressions. To avoid such a possibility we instrument the intensity of conflict using the distance to Monrovia from the epicentre of the chiefdom in kilometres. The assumption is that the closer to Liberia, the more intense the conflict in the chiefdom.[11] On the contrary, distance to Monrovia should not impact the dependent variables. Chiefdoms and firms closer to Monrovia should not be systematically different from chiefdoms and firms located further from Monrovia. Chiefdoms close to Monrovia could indeed be systematically different if, for example, roads from Sierra Leone to Liberia were important trade routes. In fact, roads between the two countries are in bad condition and

[9] These variables are obtained using the 2005 National Public Services dataset (IRCBP, GoBifo) collected in 2005. The data covers the entire country. 6341 households, clustered by census enumeration area, have been surveyed.

[10] Refer to the maps in the appendix to visualize the differences in the intensity of conflict at the district and chiefdom level.

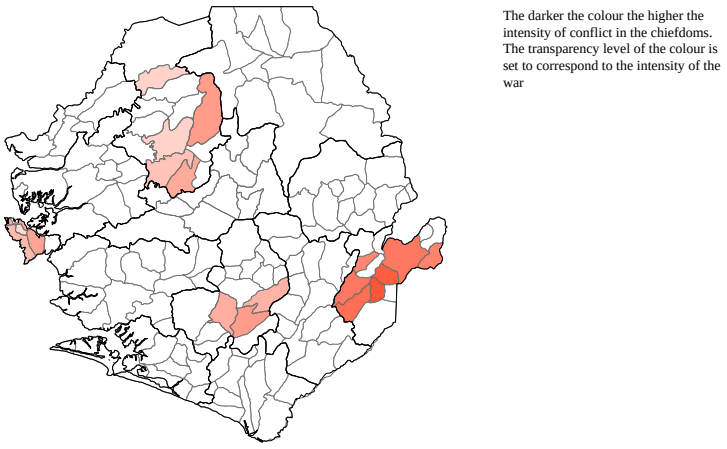
[11] As a matter of fact, it is now widely believed that the civil war in Sierra Leone was, to a great extent, orchestrated by the neighbouring Liberia. Indeed, subsequent parts of the rebel factions operating at the start of the war in 1991 appeared to have been constituted of Liberian citizens. Furthermore diamonds mined in Sierra Leone were smuggled by the rebels through the border (Smillie et al., 2000) probably in exchange for arms and ammunitions. None of these facts however have been proved so far and former President Charles Taylor's ongoing trial at the Special Court for Sierra Leone should answer some questions regarding the RUF's Liberian linkages. Charles Taylor's trial began in 2006. He is tried for his implication in the war in Sierra Leone and charged with 11 counts of Crimes against humanity and War crimes).

Figure 4: Conflict intensity by district



Source: IRCBP (2005).

Figure 5: Conflict intensity by chiefdom in four districts surveyed



Source: IRCBP (2005).

require the use of high clearance vehicles. It takes approximately eight hours to travel from Kenema, the largest town close to the border on Sierra Leone's side, to the border gate at Bo-Waterside. The last 50 kilometres are gravel roads. The heavy precipitation around the border further increases travelling difficulties in the area, especially during the rainy season (May to December). In addition, the main border bridge to cross the Mano River was closed from 1990 due to war in both countries. It only reopened in June 2007, after the data was collected. Distance to Monrovia, as a tradable route, is therefore unlikely to have played a role in the recovery of the surveyed firms. Statistically, distance to Monrovia is not significant when introduced in most of the core OLS regressions. First stage regressions confirm that the distance to Monrovia is a strong predictor of the intensity of conflict. It is highly statistically significant at a one per cent threshold in all regressions.

5 Results

We first investigate the legacy of the conflict at the chiefdom level. We then dig further in analysing the impact on the firms themselves to verify our hypothesis that civil war durably affects human capital.

5.1 At the chiefdom level: the effect of the war on the existence of firms and employment

We start the analysis by focusing on the information available at the chiefdom level. Firstly we investigate whether the intensity of the conflict had a significant impact on the number of firms now operating per chiefdom and per sector and estimate the following equation:

$$Firms_{i,j} = \alpha + \beta_1 X_i + \beta_2 intensity_i + \beta_2 intensity_i * firms_1 970_{i,j} + \sum_{j=1}^{n} \gamma_j sector_j + \sum_{j=1}^{n} \delta_j (intensity_i x sector_j) + \varepsilon_{i,j} \quad (3)$$

where i refers to the chiefdom and j to the sector. X is a set of control characteristics at the chiefdom level that includes the number of firms by sector and chiefdom in 1970. $Sector_j$ is a discrete variable taking the value of 1 for the sector j. $Intensity_i$ is the conflict intensity level of chiefdom i. The interacted terms $intensity_i$ x $sector_j$ capture a potential sectorial legacy of war.

Interestingly, there is no significant relationship between the number of firms in 2006 and the intensity of war at the chiefdom level. In addition, the interacted term between intensity of conflict and the number of firms per sector in the chiefdom is only significant at 10 percent with instrumentation, suggesting that the economy was affected as a whole, uniformily.[12] The district-fixed effects enable comparison inside a smaller geographical identity where it is thought that other external factors that could affect our dependent variables, such as climate, are rather similar. None of the sector dummies

[12]Note that certain sectors were inexistent in 1970, preventing us to investigate the ratio of the number of firms in 2006 over the number of firms in 1970.

or any of the interacted terms between the intensity variable and the sector dummies are significant. Overall the results suggest that the intensity of war did not affect the current (2006) existence of firms. Either conflict led to a uniform destruction of the economy of the whole country, or firms were rapidly reestablished following the end of the conflict. There is no identifiable sector effect of the war. The results are presented in Table 1.

Table 1: Number of firms by sector and by chiefdom in 2006

	(1) OLS	(2) IV	(3) OLS	(4) IV
Intensity	0.056	5.826	12.258	(.)
	(3.265)	(5.201)	(8.906)	
No. of firms per chiefdom/sector in 1970	0.296	-0.641	0.291	1.548
	(0.170)	(0.234)*	(0.129)	(0.474)**
No. of firms per chiefdom/sector 1970 x intensity	-0.514	2.023	-0.448	-3.586
	(0.443)	(0.639)*	(0.336)	(1.194)*
Agroactivities	-2.771	-1.141	-2.823	16.835
	(2.276)	(2.517)	(2.337)	(9.255)
Agroactivities x intensity	1.711	-2.471	1.727	8.468
	(4.063)	(5.533)	(4.143)	(23.024)
Manufacturing	0.393	-1.626	0.295	19.113
	(3.101)	(3.956)	(3.224)	(8.530)
Manufacturing x intensity	-1.565	2.475	-1.487	6.248
	(3.790)	(6.854)	(3.917)	(25.779)
Construction	-2.995	-0.665	-3.027	17.852
	(3.047)	(3.520)	(3.106)	(10.134)
Construction x intensity	1.446	-4.106	1.473	5.718
	(5.259)	(8.007)	(5.353)	(22.476)
Services	9.024	13.622	8.454	23.529
	(7.801)	(9.103)	(7.396)	(6.723)**
Services x intensity	-10.203	-24.239	-9.669	0.298
	(11.913)	(16.070)	(11.291)	(28.830)
Sales	2.017	15.647	-1.698	0.000
	(2.389)	(5.637)*	(3.974)	(.)
Sales x intensity	1.746	-39.777	5.038	57.060
	(4.634)	(16.748)*	(4.141)	(41.759)
Health and education	(.)	(.)	(.)	23.769
				(9.649)*
Health and education x intensity	(.)	(.)	(.)	-1.733
				(30.303)
Freetown	32.653	30.416		
	(1.799)***	(1.012)***		
First stage				
Instrument: distance to Monrovia		-0.001		-0.001
		(0.000)***		(0.000)***
F-test		130.69		81.72
Residuals		-13.682		56.627
		(7.144)		(71.541)
District effects			x	x
adj. R^2	0.84	0.88	0.76	0.91
N	114	114	114	114

Notes: * significant at 10%, ** at 5 %, *** at 1%. Agroactivities refer to main activity reported as fishing, forestry, poultry, livestock, and agrobusiness; manufacturing corresponds to manufacturing activities, mining and quarrying as well as electricity, gas and water; sale corresponds to retail and wholesale activities; services refer to main activity reported as repairs, hotels and restaurants, transport, communication, real estate, public administration, financial estate, and others including legal activities, etc.; the health and education sector definition regroups pharmacy, education, health, and social work activities.

Second, we look at whether the conflict affected the current (2006) level of employment by sector[13] and estimate the following equation, similar to equation (3):

$$Employment_{i,j} = \alpha + \beta_1 X_i + \beta_2 intensity_i + \sum_{j=1}^{n} \gamma_j sector_j + \sum_{j=1}^{n} \delta_j (intensity_i * sector_j) + \varepsilon_{i,j} \quad (4)$$

where, i designates the chiefdom and j the sector. X is a set of controls for chiefdom i and $sector_j$ is a discrete variable equal to 1 for the sector j. The interacted terms capture a potential different effect of the war on employment level depending on the sector considered. We can indeed envisage that some sectors of activities were more affected by the war then others.

The results are reported in Table 2. The conclusion is alike. The intensity of the war does not significantly affect current (2006) employment at the chiefdom level. Again, either Sierra Leone's labour market was affected as a whole with no apparent difference between areas where the conflict was more or less intense, or employment rapidly recovered.

[13]The proxy of the total employment is defined as the sum of number of employees reported in the firms surveyed by sector and by chiefdom.

Table 2: Employment by sector per chiefdom

	(1) OLS	(2) IV	(3) OLS	(4) IV
Intensity of conflict	10.869	112.936	364.561	
	(43.883)	(90.503)	(373.565)	
No. of firms per chiefdom/sector in 1970	-.124	-.122	0.524	0.563
	(0.018)***	(0.019)***	(0.015)***	(0.059)***
Freetown	1063.106	1066.049		
	(15.144)***	(9.771)***		
Agroactivities	-67.346	-51.163	61.564	72.336
	(47.491)	(53.371)	(64.041)	(77.570)
Agroactivities x intensity	62.856	26.812	-67.296	-976.920
	(81.764)	(114.657)	(87.595)	(1258.303)
Manufacturing	45.957	-.253	173.191	244.376
	(45.900)	(48.155)	(135.831)	(196.768)
Manufacturing x intensity	-59.422	45.912	-187.323	-1233.936
	(72.545)	(132.838)	(224.992)	(1462.912)
Construction	-32.407	2.878	97.329	140.263
	(23.774)	(23.969)	(102.683)	(148.826)
Construction x intensity	23.818	-55.505	-106.660	-1089.072
	(43.475)	(77.595)	(139.507)	(1378.600)
Services	244.171	345.547	355.834	578.856
	(275.170)	(357.745)	(372.528)	(607.542)
Services x intensity	-185.287	-414.463	-297.618	-1689.481
	(397.845)	(604.016)	(543.389)	(2124.896)
Sales				
Sale x intensity				-894.936
				(1184.210)
Health and education	-68.597	-70.929	62.251	70.750
	(48.615)	(54.862)	(61.916)	(73.915)
Health and education x intensity	82.646	88.567	-48.884	-953.175
	(78.224)	(108.171)	(90.194)	(1254.688)
Cons	-.835	-46.316	-32.239	383.069
	(38.020)	(45.698)	(200.271)	(322.913)
First stage				
Instrument: distance to Monrovia		-0.000		-0.001
		(0.000)***		(0.000)***
F-test		130.69		81.72
District effetcs			x	x
Obs	114	114	114	114
R^2	0.498	0.5	0.175	0.202

Notes: see notes Table 1.

5.2 At the firm level: effects on size, income, and needs of the firms

To investigate deeper the impact of the conflict we now use the firm level dataset.[14] We first look into the possibility that the intensity of conflict had an impact on the size of existing firms[15] while estimating:

$$Size_{k,j} = \alpha + \beta_1 X_i + \beta_2 X_k + \beta_3 conflicthistory_k + \beta_4 intensity_i + \beta_5 (intensity_i * conflicthistory_k) + \varepsilon_{i,k} \quad (5)$$

where k refers to the firm k, i to the chiefdom i, X_i are characteristics of the chiefdom i and X_k of the firm k. $conflicthistory_k$ is a set of variables capturing the history of the firm k relative to the conflict and value of 1 for the sector j. $Intensity_i$ is the conflict intensity level of chiefdom i.

We now find significant effects of the intensity of conflict. As is common, we find that the older the firm, the larger the number of employees. From the age of the firm we enter the number of years during which the firm was exposed to the conflict. Interacting this with the intensity of conflict in the area in which the firm operates, the coefficient is significant and negative with an absolute value about twice that of the direct effect of the number of years during the conflict that the firm was operating. Thus, firms operating in chiefdoms that had more intense fighting are now (2006) significantly smaller than other firms *ceteris paribus*. A possible explanation could be that they faced a shortage of labour during the conflict as workers moved into the armed forces or were displaced. This leads to a drop in terms of inputs available in a labour-intensive economy as well as a fall in demand. Note that the selection bias implies that survivor firms should be bigger where the conflict was more intense, thus potentially leading to an underestimation of the coefficient of the interactive term.

Whereas employment evidently declined as a result of the intensity of violence during the conflict, it then recovered correspondingly faster post-conflict. The coefficient on the number of years since the conflict, interacted with the intensity level of the war, is positive and significant. Recalling that the intensity measure varies on a 0 to 1 scale, the more intense the conflict was, the faster the economy recovered.

However, the rate of recovery is only half the rate of decay during the conflict. This difference is robust to instrumentation and to the inclusion of district dummies. As it happens, this ratio matches the one found in macroeconomic data on the rate of contraction during civil war and recovery post-conflict estimated by Collier and Hoeffler (2004): a country that faced an average seven years long civil war will need 14 years to reach its counterfactual GDP. In other words, it appears to take approximately twice the length of the war for both the whole national economy and for employment in a firm to recover.

[14] When studying the firms in 2006, it is important to acknowledge that the sample is de facto only constituted of firms that survived the war or were born after it.

[15] We use the number of employees as a proxy of the size of the firm.

Table 3: Size of the firms

	(1) OLS	(2) IV	(3) OLS	(4) IV
Ln no. of firms in 1970	-.204	0.213	0.447	0.423
	(0.307)	(0.26)	(0.255)*	(0.257)*
Ln no. of firms in 2006	1.048	1.193	0.18	0.225
	(0.363)***	(0.327)***	(0.24)	(0.251)
Ln population in 1985	-1.650	-1.287	-1.799	-1.780
	(0.521)***	(0.611)**	(0.639)***	(0.619)***
Age of the firms	0.178	0.183	0.17	0.166
	(0.041)***	(0.028)***	(0.04)***	(0.043)***
Intensity	13.569	26.351	1.344	2.980
	(3.494)***	(19.522)	(7.520)	(6.890)
No. of years during conflict	2.153	1.438	2.164	2.476
	(0.804)***	(2.135)	(0.775)***	(0.759)***
No. of years during conflict x intensity	-4.474	-2.749	-4.424	-5.173
	(1.467)***	(5.524)	(1.380)***	(1.278)***
No. of years since conflict	-.757	-1.268	-1.150	-1.078
	(0.275)***	(2.338)	(0.408)***	(0.223)***
No. of years since conflict x intensity	1.945	3.279	2.892	2.705
	(0.74)***	(6.116)	(1.094)***	(0.535)***
Freetown	-1.227	-2.341		
	(0.898)	(0.357)***		
Cons	11.352	-.397	20.787	19.873
	(6.554)*	(13.470)	(2.936)***	(2.821)***
First stage				
Instrument: distance to Monrovia		-0.000		-0.001
		(0.000)***		(0.000)***
F-test		28.93		45.94
District effects			x	x
N	610	610	610	610
R^2	0.018	0.017	0.019	0.019

Note: * significant at 10%, ** at 5 %, *** at 1%.

Studying the impact of conflict on the income of the firms requires the use of an ordered probit: employers were asked to answer questions on income using only ranges of income. The income variable thus varies from 1 to 7, 7 being the highest range.[16] We then estimate the following equation:

$$Pr(Income_{i,k} = c) = Pr(\kappa_{c-1} < \beta_1 X_{i,c} + \beta_2 X_{k,c} + \beta_3 intensity_{i,c} + \mu_{i,k,c} \geq \kappa_c \quad (6)$$

where $income_{i,k} \in [1; 7]$. βs are estimated together with the cut points, κ_1, κ_2,:..,κ_6.

We performed a Brant test to verify that proportional odds assumption is not violated, i.e. the

[16]The ranges proposed are: fewer then a million Le, 1 to 5 million Le, 5 to 10 million Le, 10 to 15 million Le, 20 to 25 million Le, over 25 million Le. The exchange rate between Le and US$ varies around 1/3000.

Table 4: Ordered logit regressions: income of the firms

	(1) ologit	(2) IV	(3) ologit	(4) IV
Intensity of conflict	-1.470	-6.203	-1.950	-6.180
	(1.375)	(2.755)**	(3.025)	(3.555)*
No. employees	.021	.021	.022	.022
	(.004)***	(.003)***	(.004)***	(.004)***
Ln no. of firms in 1970	-.062	-.069	-.147	-.164
	(.114)	(.120)	(.234)	(.211)
Ln no. of firms in 2006	.276	.227	.380	.443
	(.246)	(.181)	(.442)	(.452)
Ln population in 1985	-.670	-.792	-.597	-.593
	(.061)***	(.105)***	(.143)***	(.130)***
Freetown	-.047	-.055		
	(.385)	(.418)		
First stage				
Instrument: distance to Monrovia		-0.000		-0.001
		(0.000)***		(0.000)***
F-test		36.05		86.59
District effects			x	x
N	406	406	406	406
LL	-641.50	-640.09	-641.10	-639.83

Note: * significant at 10%, ** at 5 %, *** at 1%.

relationship between each pair of income groups is the same. The result suggests that the assumption is violated for the number of employees and the population of the chiefdom in 1985, but that the proportional regression assumption is not violated for the intensity of conflict variables. Moreover, the estimated coefficients are similar when we use an ordered logistic model where the proportional odds assumption is relaxed for the variables concerned. Therefore, in Table 4 only the first set of regressions are presented. The coefficients of the intensity of conflict are always negative suggesting that the more violent the conflict was, the lower the level of income of the firm *ceteris paribus*. The coefficients are only significant when the intensity is instrumented. The potential selection bias of the sample suggests that smaller firms have been destroyed and that among large firms only the most productive would have survived. It is likely that this phenomenon would have been accentuated in highly intense conflict zones. As a result the coefficient of the intensity of conflict variable should be upward biased, consequently the negative effect on the income of firms might have been even lower if smaller firms and unproductive large firms had survived.

On the one hand, the intensity of conflict did not affect either the existence of firms or their current (2006) employment level. On the other hand, however, it had a negative effect on both the size and the income of the firm. The findings imply that the conflict affected the availability and quality of capital. Hence, it gives us a first sense confirming the theory developed earlier that conflict affects firms by destroying their human capital. The design of the SLES employers survey enables us to investigate

this hypothesis more deeply through data on staff training. Specifically, we investigate whether the intensity of conflict affects the reported willingness of employers to pay for training of their staff.[17] The underlying assumption is that the more employers feel a need to train their employees the more severe their shortage of qualified labour must be. We therefore estimate the following equation using a probit model:

$$Willingness^*_{i,k} = \alpha + \beta_1 X_i + \beta_2 X_k + \beta_3 intensity_i + \beta_4 sector_k + \beta_5 (intensity_i * sector_k) + \varepsilon_{i,k} \quad (7)$$

where *willingness* is a dummy variable on whether the employer of the firm k operating in chiefdom i wants to invest more in the training of his employees. X_i and X_k are vectors of variables relative to the chiefdom i and to the firm k. $Sector_k$ is a discrete variable equal to one when the firm k operates in the sector considered and zero otherwise. $Intensity_i$ refers to the intensity of the war in chiefdom i. The results are reported in Table 5 and 6. We are particularly interested in the sign and significance level of β_3 that captures the direct effect of the intensity of war, and β_5 the potential sectorial effect of the conflict.

We acknowledge that the willingness to pay for training variable might not be the ideal proxy for human capital and could in fact capture unobserved characteristics such as wealth effects, credit constraints or the costs of physical capital. However, we control for whether financing is one of the main constraints for growth and expansion and whether physical assets where acquired in the two years preceding the interview. Before introducing those as controls in the regression, we investigated whether there is a significant relationship between the financing constraint, capital investment, and the intensity of conflict. We observe a positive impact of the intensity of conflict on the probability that the firm faces major financing constraints (Table 9). By contrast there is no significant relationship between the intensity of conflict in the zone and the proxy for capital investment. An explanation may be that physical capital levels might already have caught up in more destroyed areas as the data is collected five years after the peace agreement. In the light of those primary findings we introduced an interacted term between the intensity of conflict and the financial constraint dummy.

We find a positive and significant effect of the intensity variable. Although the coefficients are only significant without the inclusion of district effects, they are always positive. Thus, conflict appears to cause a scarcity of skills in those chiefdoms where the war was more intense, as indicated by the greater need to train. The reported marginal effects are strikingly high. This is consistent with our theory of 'forgetting by not doing': in areas where the conflict was more intense, employers show a significant higher need for human capital than in regions less affected by conflict, thus controlling for financial constraint and physical capital investment. The coefficient of the latter is positive but never

[17] Employers were asked whether or not they would be willing to pay for the training of their employees.

significant which tends to confirm that human and physical capital are complementary rather than substitutes. Indeed, if they were substitutes we would expect firms who did not invest in physical capital to significantly compensate by training staff and as a result increasing human capital levels. On the contrary, the results suggest that, if anything, investing in new assets leads to a higher need for skills. Financial constraints, on the other hand, seem to increase the need for training staff, which would imply that when employers are constrained to invest, they train their staff. Training may not been positive. Say a clothing manufacture might need to train its employees to work manually as it cannot pay for new machines. However, the coefficient of the interacted term is significant and negative, underlying that the effect of the financial constraint is lowered by the intensity of conflict. We also investigate the willingness to pay for training of skilled staff as a robustness test. As discussed earlier, skilled labour elasticity to physical capital is lower than unskilled labour. The results presented in Table 11 and 12 display the same patterns, confirming the 'forgetting by not doing' effect, although the coefficients of the intensity of conflict variable show lower levels of significance.

In addition, we observe variations between sectors. Employers in the health and education sectors are significantly more willing to pay for training in conflict-affected areas. Possibly this is so, because these sectors are particularly skill-intensive, requiring workers such as pharmacists, medical staff, or teachers, whose training most likely occurs in Freetown. The same effect is distinguishable in the agrobusiness sector, although for different reasons. In the construction sector, the willingness to pay for training of the staff is higher, but we observe the opposite phenomenon in chiefdoms more affected by the war. Entrepreneurs are less likely to invest in training in those areas. One possible explanation is that as of 2006 reconstruction mainly occurred in Freetown, which was relatively less destroyed during the war than other parts of the country, but was nevertheless the core of post-conflict government attention. In more rural areas in the East, reconstruction had barely started by 2006.

The effect of the selection bias is unknown. If it is likely to bias the coefficient of the size of firms, it is only a control variable. However it is not clear how it impacts, if at all, the war intensity coefficients.

6 Conclusion

Using a firm survey, we investigated the economic legacy of the 1991-2002 war in Sierra Leone. The theory proposed is that conflict results in a significant loss in human capital stock as a result of a 'forgetting by not doing' phenomenon, broadly analogous to learning by doing. Civil war induces the reversion to more subsistence activities and less sophisticated techniques so that skills atrophy. During the post-conflict phase the growth of firms is therefore slower as human capital has become scarce and

Table 5: Willingness to pay for training (1)

	(1) Probit	(2) IV	(3) Probit	(4) IV
Agroactivities				
Sector	-0.186	-4.891	-0.187	-0.197
	(0.045)***	(3.565)	(0.030)***	(0.015)***
Acquire assets=1	0.061	0.205	0.053	0.053
	(0.058)	(0.232)	(0.060)	(0.061)
Financial constraint=1	0.654	2.609	0.676	0.687
	(0.180)***	(1.696)	(0.206)***	(0.221)***
Intensity	0.749	6.112	0.388	0.450
	(0.267)***	(3.197)*	(0.563)	(0.519)
Intensity x fin. constraint	-1.101	-5.172	-1.143	-1.181
	(0.287)***	(3.781)	(0.367)***	(0.450)***
Intensity x sector	1.458	12.933	1.536	2.014
	(1.030)	(8.022)	(0.888)*	(0.805)**
Manufacturing				
Sector	0.188	1.343	0.144	0.058
	(0.361)	(0.654)**	(0.267)	(0.140)
Acquire assets=1	0.070	0.245	0.059	0.058
	(0.055)	(0.222)	(0.056)	(0.057)
Financial constraint=1	0.618	2.711	0.644	0.682
	(0.196)***	(1.615)*	(0.218)***	(0.211)***
Intensity	0.854	6.672	0.438	0.360
	(0.313)***	(3.163)**	(0.582)	(0.362)
Intensity x fin. constraint	-1.013	-5.402	-1.064	-1.169
	(0.292)***	(3.542)	(0.361)***	(0.393)***
Intensity x sector	-0.097	-1.966	-0.073	0.118
	(0.646)	(1.420)	(0.513)	(0.326)
Construction				
Sector	0.884	1.097	0.888	0.871
	(0.015)***	(0.730)	(0.007)***	(0.111)***
Acquire assets=1	0.053	0.190	0.046	0.047
	(0.061)	(0.240)	(0.060)	(0.061)
Financial constraint=1	0.644	2.562	0.672	0.665
	(0.145)***	(1.512)*	(0.175)***	(0.188)***
Intensity	0.994	6.859	0.642	0.336
	(0.164)***	(3.023)**	(0.450)	(0.455)
Intensity x fin. constraint	-1.067	-5.051	-1.125	-1.113
	(0.195)***	(3.425)	(0.281)***	(0.348)***
Intensity x sector	-4.720	1.663	-4.866	-3.080
	(0.194)***	(2.417)	(0.400)***	(11.608)
Freetown dummy	x	x		
District effects			x	x
Obs	379	379	379	379

Notes: * significant at 10%, ** at 5 %, *** at 1%. We control for the number of employees and the income of the firm, for the log of the number of firms per chiefdom in 1970 and in 2006 and for the log of the population per chiefdom in 1985. The instrument is always significant in the first stage regressions. Coefficients are not reported for readability reasons.

Table 6: Willingness to pay for training (2)

	(1) Probit	(2) IV	(3) Probit	(4) IV
Sales				
Sector	-0.111	-0.751	-0.092	-0.068
	(0.083)	(0.547)	(0.048)*	(0.107)
Acquire assets=1	0.061	0.216	0.055	0.053
	(0.046)	(0.191)	(0.046)	(0.048)
Financial constraint=1	0.597	2.635	0.595	0.611
	(0.177)***	(1.623)	(0.212)***	(0.234)***
Intensity	0.835	6.196	0.786	3.983
	(0.291)***	(0.588)	(0.721)	(0.669)
Intensity x fin. constraint	-0.950	-5.212	-0.934	-0.976
	(0.243)***	(3.589)	(0.321)***	(0.408)**
Intensity x sector	-0.146	0.224	-0.169	-0.217
	(0.197)	(1.461)	(0.072)**	(0.249)
Health & Education				
Sector	-0.160	-0.735	-0.168	-0.171
	(0.035)***	(1.300)	(0.045)***	(0.046)***
Acquire assets=1	0.065	0.217	0.059	0.059
	(0.064)	(0.250)	(0.063)	(0.063)
Financial constraint=1	0.596	2.521	0.608	0.592
	(0.180)***	(1.487)*	(0.214)***	(0.248)**
Intensity	0.676	6.659	0.496	0.545
	(0.283)**	(2.998)**	(0.603)	(0.526)
Intensity x fin. constraint	-0.956	-4.925	-0.971	-0.935
	(0.267)***	(3.254)	(0.344)***	(0.446)**
Intensity x sector	0.754	2.360	0.799	0.804
	(0.131)***	(3.419)	(0.187)***	(0.185)***
Services				
Sector	0.051	0.908	0.149	0.235
	(0.160)	(0.575)	(0.131)	(0.137)*
Acquire assets=1	0.062	0.209	0.053	0.052
	(0.063)	(0.244)	(0.063)	(0.063)
Financial constraint=1	0.617	2.781	0.656	0.685
	(0.182)***	(1.648)*	(0.219)***	(0.236)***
Intensity	0.788	6.953	0.389	0.422
	(0.320)**	(3.562)*	(0.561)	(0.477)
Intensity x fin. constraint	-1.001	-5.559	-1.087	-1.171
	(0.288)***	(3.677)	(0.396)***	(0.495)**
Intensity x sector	-0.079	-2.182	-0.286	-0.455
	(0.368)	(1.458)	(0.263)	(0.254)*
Freetown dummy	x	x		
District effects			x	x
Obs	379	379	379	379

Notes: see notes Table 5.

takes time to rebuild.

Our results support this hypothesis. Using geographical variations in the intensity of conflict, we find that the more firms were exposed to conflict the smaller they were as of 2006. However, such firms also tended to recover faster once peace was restored. The rate of recovery was approximately half the rate of decay during the war, corresponding to the macroeconomic effects of conflict and recovery estimated by Collier and Hoeffler (2004).

The analysis of training patterns confirms the lack of skills experienced as a result of war. Entrepreneurs' willingness to pay for the training of their staff is significantly higher in those areas of the country most affected by the conflict, indicating a more acute shortage of skilled labour.

As a result of this observation, post-conflict governments should prioritize training in sectors that produce non-tradable goods, especially the capital non-tradable goods.

The 'forgetting by not doing' phenomenon has important implications for the recovery of a country. Indeed, firms have to make do with lower quality workers. This impacts negatively their productivity and the acquisition of new techniques of production. As a result, the growth process is likely to be slowed down. In fact, post-conflict environments experience a 'supra-normal growth', underlying a catching up of the economy, potentially driven by the physical reconstruction. The rate of catching up is, however, diminished by the destruction of human capital, which takes long to recover, if ever, its counterfactual. Firms are also less competitive and exports will suffer accordingly. If the lack of skills in post-conflict economies is tackled early, it is likely that recovery would be much faster.

The lack of skills can also have much longer term consequences. Indeed, civil war not only deskills the existing labour force, but conflict also implies huge disturbances in schooling. The education system collapses often completely and children miss important years of schooling. As mentioned earlier, in Sierra Leone children were forcibly enrolled in the guerilla, some as young as age seven. Once peace is settled, there is a clear necessity to reconstruct the education system but no competences in the economy to achieve it. If not addressed, generations will continue to be lost. Formation and training appear as a necessity, but they are too few competent teachers or trainers. A solution is to encourage the diaspora to return and pass on the knowledge they acquired abroad during wartime.

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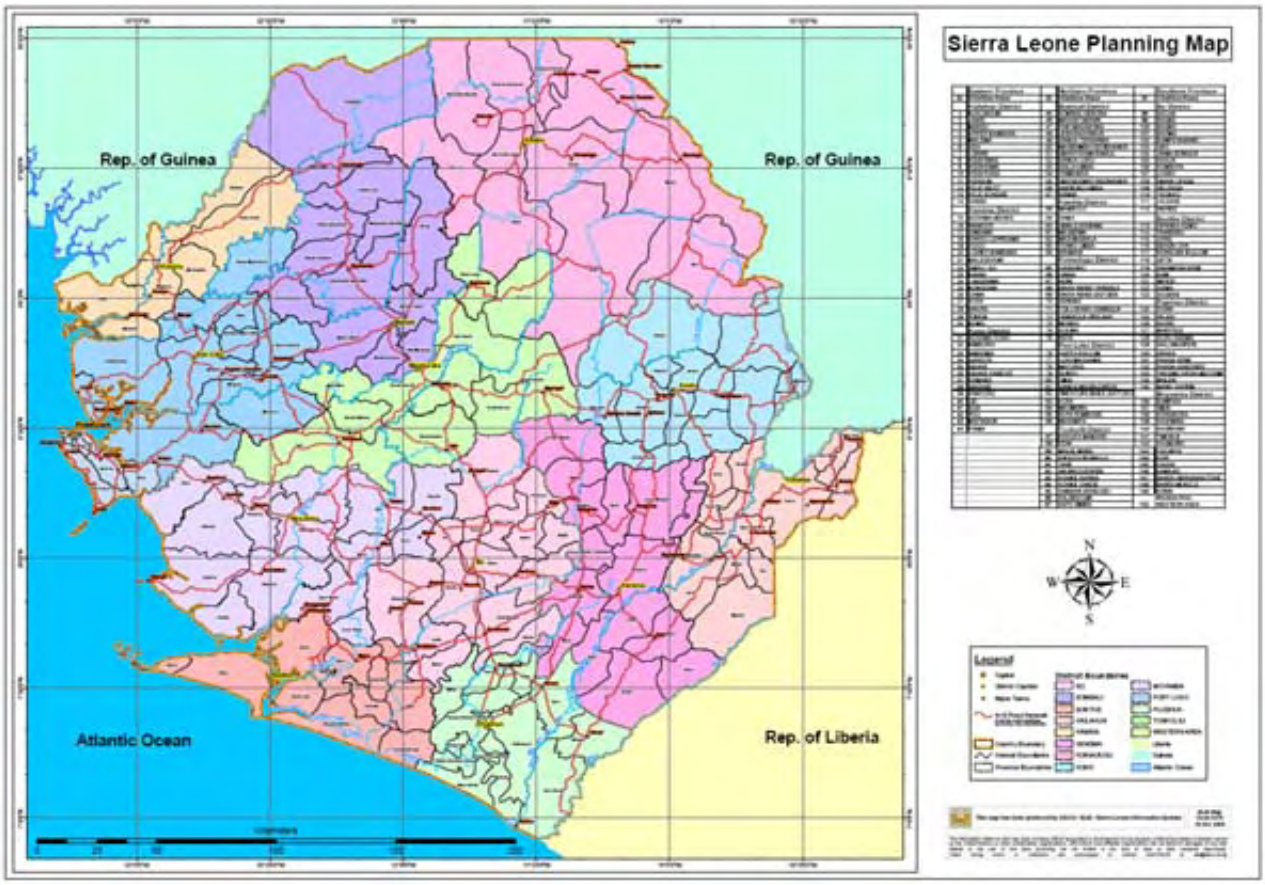
7 Appendix

Figure 6: Map of Sierra Leone



Source: UNDP and DACO/SLIS.

Table 7: Descriptive statistics

	Obs	Mean	Std. Dev.	Min	Max
Conflict intensity	846	0.396312	0.0688547	0.1708333	0.7894737
Freetown	847	0.6174734	0.4862913	0	1
Age of the firm	678	9.079646	10.70704	0	86
Years of operation during conflict	830	2.191566	3.696988	0	10
No. of employees	691	13.17945	59.14889	0	1350
Income of the firm	406	9315271	9939713	500000	2.75e+07
Willingness to invest in training	678	0.2020649	0.4018368	0	1
Financial constraints	689	0.394775	0.4891574	0	1
Acquire assets	675	0.3081481	0.4620705	0	1

Table 8: Firms by sectors of activities

	Freq.	Percent	Cum. percent
Agro activities	27	4.04	4.04
Construction	20	2.99	7.03
Health and education	63	9.42	16.44
Manufacturing	63	9.42	25.86
Sales	321	47.98	73.84
Services	175	26.16	100.00
Total	669	100.00	

Table 9: Financial constraint

	(1) Probit	(2) IV	(3) Probit	(4) IV
Intensity	1.061	1.992	1.362	1.210
	(0.289)***	(0.217)***	(0.966)	(0.320)***
No. of employees	0.001	0.001	0.001	0.001
	(0.001)*	(0.001)	(0.000)*	(0.001)*
Firm revenue	-0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Ln no. of firms in 1970	0.036	0.048	0.097	0.083
	(0.033)	(0.035)	(0.035)***	(0.033)**
Ln no. of firms in 2006	-0.056	-0.048	-0.126	-0.115
	(0.032)*	(0.036)	(0.025)***	(0.016)***
Ln population in 1985	0.203	0.234	0.185	0.187
	(0.026)***	(0.019)***	(0.035)***	(0.034)***
Freetown	0.009	-0.016		
	(0.065)	(0.067)		
First stage				
Instrument: distance to Monrovia		-0.001		-0.001
		(0.000)***		(0.000)***
F-test		45.91		178.13
District effects			x	x
Pseudo R^2	0.063	0.063	0.068	0.065
Observations	398	398	398	398

Note: * significant at 10%, ** at 5 %, *** at 1%.

Table 10: Physical investment: were new assets acquired during the past two years?

	(1) Probit	(2) IV	(3) Probit	(4) IV
Intensity	0.297	0.369	-0.917	0.294
	(0.100)***	(0.333)	(0.712)	(0.771)
Financial constraint=1	-0.023	-0.024	-0.022	-0.029
	(0.040)	(0.038)	(0.037)	(0.041)
No. of employees	0.001	0.001	0.001	0.001
	(0.000)**	(0.001)**	(0.001)**	(0.001)**
Firm revenue	0.000	0.000	0.000	0.000
	(0.000)***	(0.000)***	(0.000)***	(0.000)***
Ln no. of firms in 1970	-0.053	-0.052	-0.082	-0.074
	(0.023)**	(0.022)**	(0.041)**	(0.019)***
Ln no. of firms in 2006	-0.022	-0.021	0.016	-0.001
	(0.013)*	(0.015)	(0.064)	(0.030)
Ln population in 1985	0.206	0.207	0.220	0.234
	(0.023)***	(0.031)***	(0.033)***	(0.031)***
Freetown	-0.082	-0.086		
	(0.067)	(0.055)		
First stage				
Instrument: distance to Monrovia		-0.001		-0.001
		(0.000)***		(0.000)***
F-test		54.98		167.07
District effects			x	x
Pseudo R^2	0.096	0.096	0.10	0.100
Observations	398	398	398	398

Note: * significant at 10%, ** at 5 %, *** at 1%.

Table 11: Willingness to pay for training of skilled workers (1)

	(1) Probit	(2) IV	(3) Probit	(4) IV
Agroactivities				
Sector	-0.121	-5.802	-0.112	-0.119
	(0.025)***	(3.452)*	(0.020)***	(0.009)***
Acquire assets=1	0.064	0.291	0.060	0.066
	(0.041)	(0.225)	(0.045)	(0.044)
Financial constraint=1	0.334	0.923	0.376	0.456
	(0.059)***	(1.683)	(0.090)***	(0.081)***
Intensity	0.339	4.212	-0.147	0.557
	(0.148)**	(2.843)	(0.339)	(0.670
Intensity x fin. constraint	-0.503	-1.599	-0.567	-0.710
	(0.143)***	(4.268)	(0.175)***	(0.152)***
Intensity x sector	1.190	15.468	1.184	1.574
	(0.824)	(7.774)**	(0.651)*	(0.544)***
Manufacturing				
Sector	0.127	0.999	0.081	0.032
	(0.185)	(1.137)	(0.123)	(0.111)
Acquire assets=1	0.072	0.339	0.064	0.070
	(0.041)*	(0.222)	(0.045)	(0.044)
Financial constraint=1	0.279	1.200	0.328	0.439
	(0.054)***	(1.491)	(0.087)***	(0.073)***
Intensity	0.447	5.100	-0.124	0.437
	(0.180)**	(3.083)*	(0.336)	(0.665)
Intensity x fin. constraint	-0.414	-2.265	-0.493	-0.686
	(0.127)***	(3.748)	(0.168)***	(0.133)***
Intensity x sector	0.015	-0.884	0.051	0.166
	(0.291)	(2.416)	(0.247)	(0.197)
Construction				
Sector	0.941	-2.200	0.944	0.960
	(0.009)***	(1.202)*	(0.007)***	(0.083)***
Acquire assets=1	0.052	0.247	0.048	0.052
	(0.043)	(0.227)	(0.045)	(0.040)
Financial constraint=1	0.341	0.856	0.382	0.405
	(0.042)***	(1.597)	(0.054)***	(0.062)***
Intensity	0.607	5.210	0.071	0.398
	(0.144)***	(2.821)*	(0.582)	(0.665)
Intensity x fin. constraint	-0.498	-1.375	-0.560	-0.606
	(0.049)***	(4.051)	(0.085)***	(0.108)***
Intensity x sector	-4.566	9.558	-4.065	-6.436
	(0.053)***	(2.243)***	(0.343)***	(14.946)
Freetown dummy	x	x		
District effects			x	x
Obs	379	379	379	379

Notes: * significant at 10%, ** at 5 %, *** at 1%. We control for the number of employees and the income of the firm, for the log of the number of firms per chiefdom in 1970 and in 2006 and for the log of the population per chiefdom in 1985. The instrument is always significant in the first stage regressions. Coefficients are not reported for readability reasons.

Table 12: Willingness to pay for training of skilled workers (2)

	(1) Probit	(2) IV	(3) Probit	(4) IV
Sales				
Sector	0.114	0.620	0.111	0.184
	(0.125)	(1.285)	(0.104)	(0.101)*
Acquire assets=1	0.063	0.315	0.062	0.067
	(0.033)*	(0.178)*	(0.036)*	(0.036)*
Financial constraint=1	0.235	0.788	0.224	0.253
	(0.036)***	(1.580)	(0.054)***	(0.071)***
Intensity	0.631	6.150	0.648	1.486
	(0.249)**	(4.172)	(0.122)***	(0.558)***
Intensity x fin. constraint	-0.313	-1.182	-0.302	-0.353
	(0.084)***	(4.051)	(0.121)**	(0.143)**
Intensity x sector	-0.615	-3.293	-0.593	-0.808
	(0.237)***	(2.609)	(0.181)***	(0.229)***
Health & Education				
Sector	-0.148	-2.465	-0.139	-0.146
	(0.009)***	(2.062)	(0.012)***	(0.008)***
Acquire assets=1	0.070	0.327	0.067	0.075
	(0.048)	(0.249)	(0.048)	(0.048)
Financial constraint=1	0.250	0.718	0.278	0.292
	(0.044)***	(1.482)	(0.080)***	(0.092)***
Intensity	0.226	3.842	0.028	0.758
	(0.170)	(2.918)	(0.204)	(0.523)
Intensity x fin. constraint	-0.339	-0.985	-0.390	-0.415
	(0.107)***	(3.737)	(0.157)**	(0.170)**
Intensity x sector	1.127	6.284	1.048	1.248
	(0.188)***	(4.720)	(0.225)***	(0.154)***
Services				
Sector	-0.098	0.185	-0.028	0.009
	(0.065)	(0.550)	(0.089)	(0.115)
Acquire assets=1	0.065	0.291	0.058	0.064
	(0.047)	(0.242)	(0.049)	(0.049)
Financial constraint=1	0.251	1.049	0.311	0.397
	(0.050)***	(1.515)	(0.096)***	(0.113)***
Intensity	0.291	4.873	-0.173	0.450
	(0.162)*	(2.992)	(0.344)	(0.687)
Intensity x fin. constraint	-0.342	-1.849	-0.448	-0.604
	(0.125)***	(3.857)	(0.195)**	(0.209)***
Intensity x sector	0.327	-0.428	0.094	-0.005
	(0.254)	(1.242)	(0.247)	(0.270)
Freetown dummy	x	x		
District effects			x	x
Obs	379	379	379	379

Notes: see notes in Table 11.